THE INSTALLATION OF DUST-COLLECTING FANS ON THRASHING MACHINES FOR THE PREVENTION OF EXPLOSIONS AND FIRES AND FOR GRAIN CLEANING

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PREPARE FOR THE NEXT THRASHING SEASON.

Protect thrashing machinery and grain against DUST EXPLOSIONS AND FIRES by the installation of—

1. An effective dust-collecting fan.
2. An approved type of fire extinguisher.
3. A wiring system for the removal of static electricity.

Further information concerning the various phases of this work can be obtained from the following bureaus of the United States Department of Agriculture, Washington, D. C.—

Dust Explosion and Fire Prevention, Bureau of Chemistry.

Grain Cleaning at Time of Thrashing by Fans and Aspirators, Bureau of Markets.

Smut Control Problems, Bureau of Plant Industry.

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THRASHER EXPLOSIONS AND FIRES IN THE PACIFIC NORTHWEST.

EACH thrashing season costs southeastern Washington and the adjoining sections of Idaho and Oregon from $15,000 to $75,000 in machinery and grain destroyed by preventable explosions and fires in thrashing machines. This loss, which may seem insignificant in comparison with the $1,000,000 damage resulting from the same cause in 1914 and 1915, is still serious enough to demand of every thrasherman in that section careful consideration of the means for preventing such disasters in the future. Investigations of explosions and fires in thrashing machines, which were begun in 1914 by the Bureau of Chemistry and the Bureau of Public Roads,[1] were continued in the Pacific Northwest during the seasons of 1917, 1918, and 1919 cooperatively by the Bureau of Chemistry, the Bureau of Markets, and the Bureau of Plant Industry, of the United States Department of Agriculture. During the season of 1918 the work was extended to other grain-growing sections of the country.

DUST-COLLECTING FANS.

Of the various devices developed by the United States Department of Agriculture for the prevention of grain and smut dust explosions and fires in thrashing machines, special dust-collecting fans designed for installation on the machines have been found to be effective in:

1. The prevention of explosions and fires in thrashing machines, by collecting the dust from the interior of the separators, thus preventing the formation therein of explosive mixtures of smut or grain dust and air.

2. The cleaning of grain, particularly of smut, as an economic feature in grain handling because of its effect on the grading of wheat under the Federal standards (grades).

3. The control of the wind dissemination of smut spores.

In addition, these fans materially improve working conditions about the machine.

Such fans should be installed on as many grain separators as possible, particularly in the Pacific Northwest, and in all other grain-growing sections where bunt or stinking smut of wheat is prevalent.

[1] U. S. Dept. Agr. Bul. 379.

DESIGN, CONSTRUCTION, AND INSTALLATION OF FANS.

GENERAL POINTS.

Because of the peculiar and characteristic construction of the various makes of thrashing machines it is impossible to give detailed specifications of a fan installation adaptable to all types of grain separators. Details of construction and the method of attachment of equipment vary with each machine. In the selection and installation of dust-collecting fans, special attention should be given to many important features. Extensive investigations and experiments have shown that to be most effective and satisfactory such equipment for thrashers should embody as many as possible of the following general points of design and construction.

1. A centrifugal-type, steel-plate exhaust fan is most desirable.

2. A single-inlet-type fan has the advantage of offering the least obstruction to the deck.

3. The fan drive should be as direct as possible from the cylinder shaft. The fan pulley should be as large as practicable to prevent undue slippage of the belt. A minimum diameter of 4 inches is suggested.

4. A light-running fan, of simple but rigid construction, securely attached to the frame of the separator, answers the purpose best.

5. Ample exterior bearings should be provided, with no overhang of the shaft.

6. For medium-sized machines, ranging from 26 by 46 inches to 32 by 54 inches, the fan should have a peripheral speed of approximately 6,500 feet per minute, with a capacity, under field conditions, of from 35 to 40 cubic feet of air per second. These values would be slightly greater for the larger and slightly less for the smaller machines. With fans of different sizes the revolutions per minute may be varied to obtain the constant peripheral speed suggested. Based on these figures, a fan of average size, 21 inches in diameter from tip to tip of vanes, should run at a speed of approximately 1,200 revolutions per minute. The same results could be secured with a larger fan operated at a lower speed or with a smaller one operated at a higher speed. The smaller fan, of course, has the advantage of occupying less space. The air resistance of such a fan operating under general thrashing conditions would be a pressure of approximately two ounces. Because of the many variables which enter into the operation of a fan, it obviously is almost impossible to give definite information on this subject.

7. The eye or inlet of the fan should be located opposite the fan pulley at the center of the casing. The discharge pipe should have an area at least as great as that of the inlet.

8. To collect dust and other light foreign material from the separator most effectively without removing the heavier particles, a fan must handle or remove a large volume of air with a very gentle movement at the intake, the velocity of the air increasing as it approaches the inlet or eye of the fan. This condition is produced by means of a tapered intake of large area at its base.

9. The intake hood should be tapered and the intake should cover a deck area of not less than 600 square inches.

10. The intake should be centered and placed at a forward position on the deck. On most machines this location would be over the beater.

11. If straw, grain, or other heavy material is thrown upward into the fan intake by the beater or cylinder of the separator, it will be necessary to place a deflection plate or baffle board, preferably metallic, under the intake at an angle of approximately 30° with the deck.

12. The absence of sharp, abrupt curves or bends in the intake and connecting parts is most important. Elbows of all piping should have an ample sweep or radius. If possible, no turn in an air pipe should be made with a radius of less than twice the pipe diameter.

13. The least possible obstruction should be offered by the fan equipment to the deck and to the interior of the machine through the deck doors.

14. The fan discharge should be conducted through a metal pipe to the rear of the separator; thence by a canvas tube into the base of the straw stack. Such an arrangement greatly reduces the wind dissemination of, and subsequent soil infestation by, smut spores which otherwise would be blown into the air.

15. If two or more discharge pipes are united, the cross-sectional area of the final common pipe should be approximately equal to the combined cross-sectional area of the original pipes. Otherwise the efficiency of the fan is greatly impaired.

VARIOUS TYPES OF FAN INSTALLATIONS.

During the past few years various thrashing-machine companies have manufactured and installed, at the suggestion of the United States Department of Agriculture, special fan equipment on numerous machines operating principally in the Pacific Northwest. Investigations have been conducted at these machines to determine the effectiveness of, and to make every possible improvement in, the different fan installations. A number of the most effective and satisfactory types of these fans are shown and discussed in the following pages.

1. **A single-inlet fan, having a diameter of 30 inches and a peripheral width of 6 inches (outside dimensions), installed on a 32 by 54 inch separator** (fig. 1).—This fan is admirably driven directly from the cylinder shaft at a speed of 1,000 revolutions per minute, and the whole equipment is well constructed and rigidly attached to the separator frame.

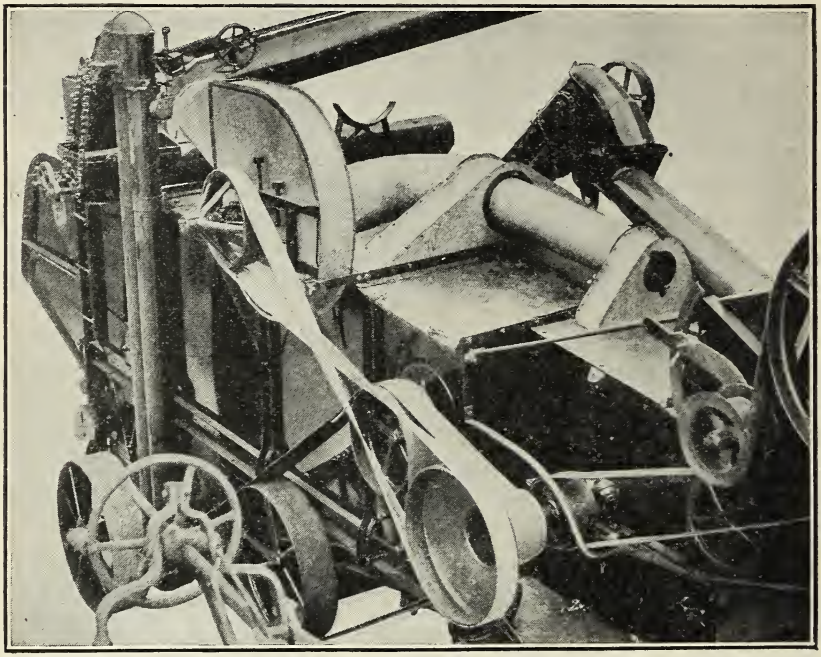

FIGURE 1.

The two intakes, one over the cylinder, the other above and just back of the beater, should be noted. A metal deflection plate placed directly under the front intake, at an angle of about 30° with the deck, prevents the cylinder from throwing into this intake any straw, grain, or other heavy material. This fan removes large quantities of dust, mainly through the rear intake. The equipment would no doubt be more effective if the front intake were eliminated, the rear intake enlarged and moved forward slightly, and the intake hood built along pyramidal lines, with no sharp, abrupt curves.

2. A three-fan installation, consisting of a double, built-in fan with a single shaft, located over the beater, and a single fan placed midway on the deck of a 23 by 36 inch separator (fig. 2).—Each unit of the double fan has one inlet, while the single fan is provided with two inlets. Each fan has a diameter of 18 inches and a peripheral width of 6 inches (outside dimensions). The speed of each fan is 1,000 revolutions per minute. The single fan is driven from the double fan shaft, which in turn is driven from the shaft of the first beater.

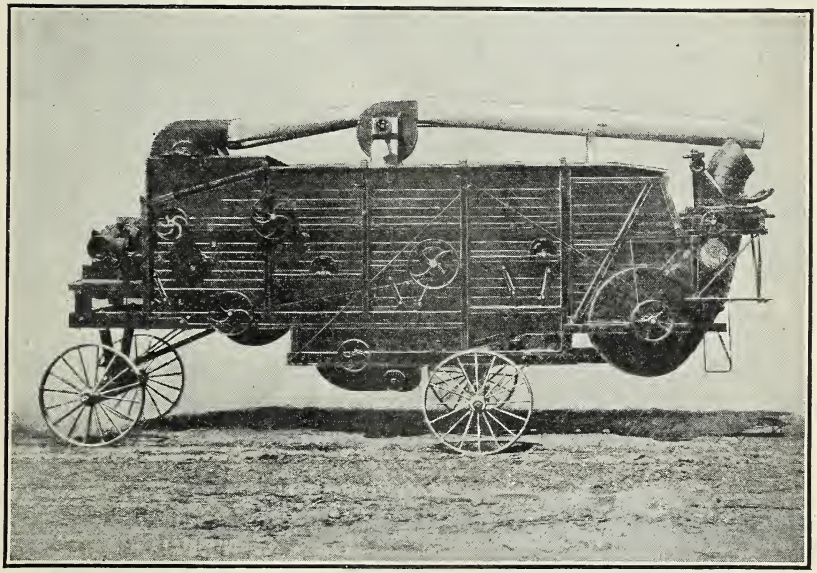

FIGURE 2.

This equipment collects large quantities of dust. Doubtless equally as satisfactory results could be obtained in a more economical manner by removing the single fan and increasing the speed of the double fan to approximately 1,200 revolutions per minute. In the union of the three discharge pipes shown, the final or common discharge pipe should be enlarged so that its cross-sectional area would approximately equal the combined cross-sectional area of the original pipes. Otherwise the fans will not operate at their maximum efficiency.

FIGURE 3.

3. A 28 by 44 inch separator equipped with a single-inlet fan with a diameter of 26 inches and a peripheral width of 6 inches (outside dimensions (figs. 3, 4, and 5).—The entire fan equipment is constructed of metal. The fan is driven from the cylinder shaft at a speed of 1,300 revolutions per minute.

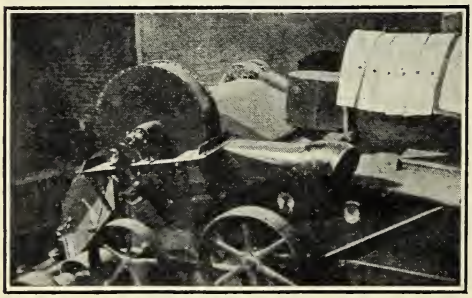

FIGURE 4.

The noteworthy features of this type of installation are (1) the large tapering intake over the first beater, (2) the rigid construction and attachment of the equipment, (3) the belt tightener for starting and stopping the fan, and (4) the movable joint at the end of the fan-discharge pipe.

4. A double-inlet metal fan with tapered intakes located over the beater on a 20 by 32 inch machine (fig. 6).— This fan is run at a speed of 900 revolutions per minute and has a diameter of 23 inches and a peripheral width of 8 inches (outside dimensions). This equipment shows good

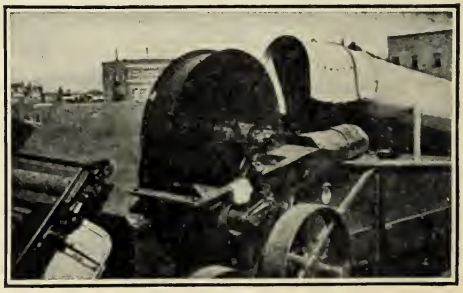

FIGURE 5.

design and construction, but would be more effective if driven from either the cylinder or the beater shaft at a speed of about 1,200 revolutions per minute, with a driven pulley at least 4 inches in diameter.

A metal deflection plate beneath the two intakes, placed at an angle of approximately 30° with the deck, prevents clogging of the fan with straw, grain, and other heavy material.

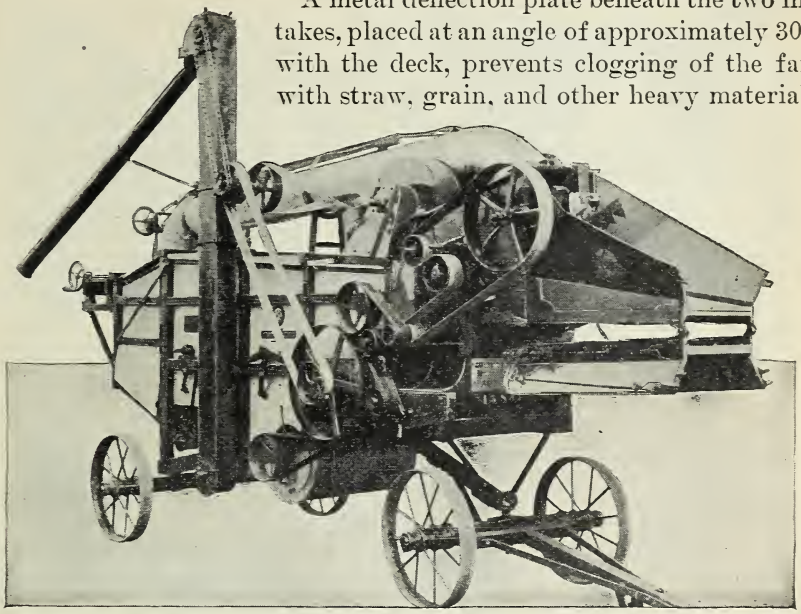

FIGURE 6.

5. A wooden, 22½ by 12 inch (outside dimensions of drum) fan installed over the second beater on a 36 by 60 inch separator (figs. 7 and 8).—The

FIGURE 7.

fan is driven from the cylinder shaft at a speed of 1,300 revolutions per minute.

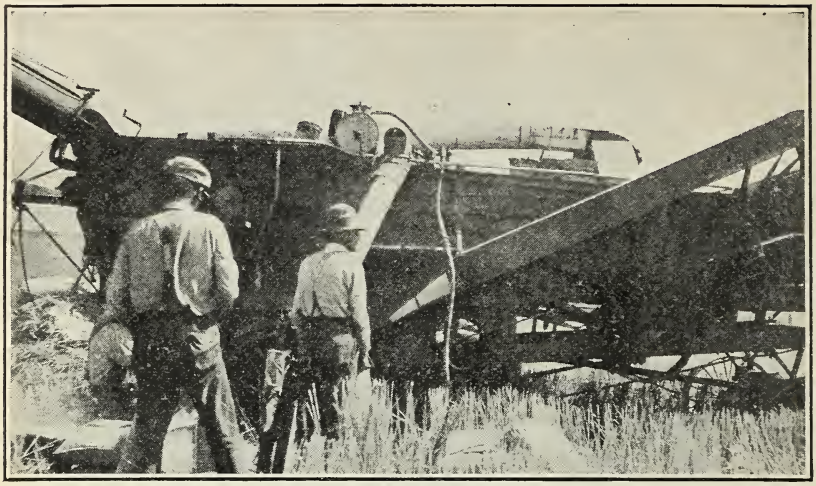

FIGURE 8.

This former double-inlet, box-type fan was changed to a single-inlet type, the following alterations being made: The fan shaft was shortened, one intake and hood removed, and the fan was moved to the side of the deck. The remaining intake hood or box was tapered and the single inlet in the fan drum was enlarged. The

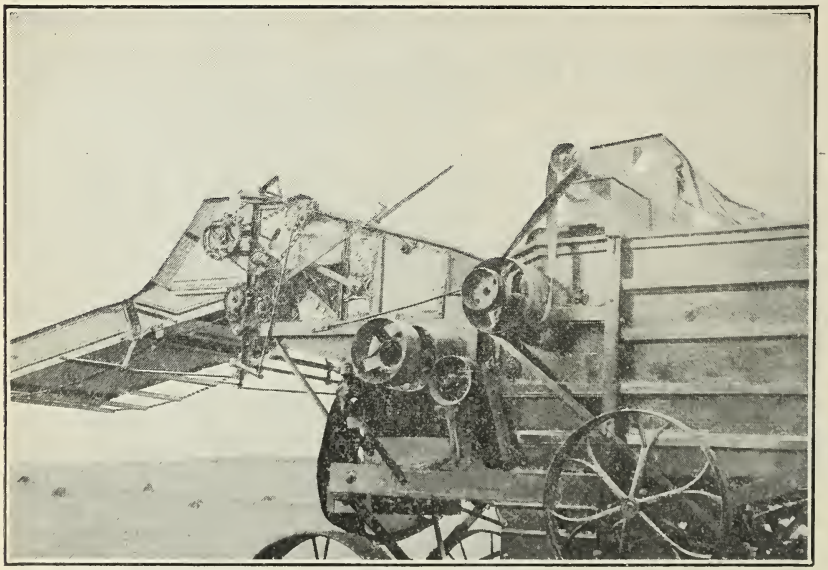

FIGURE 9.

speed of the fan was increased from 900 to 1,300 revolutions per minute. This simply constructed, light-running fan removes large quantities of dust. The straight metallic discharge pipe offers very little resistance to the passage of the dust-laden air.

Attention is called to the dual fire extinguishing system, consisting essentially of a chemical fire extinguisher on the deck and a steam hose line running to the steam engine. Each unit is connected to a piping system, by means of which the interior of the separator is sprayed in case of an explosion or fire.

6. A wooden, double-inlet, box-type fan, with a 22½ by 10 inch drum (exterior dimensions), placed over the beater on a 36 by 56 inch separator (fig. 9).—This fan is driven from the beater shaft at a speed of 800 revolutions per minute.

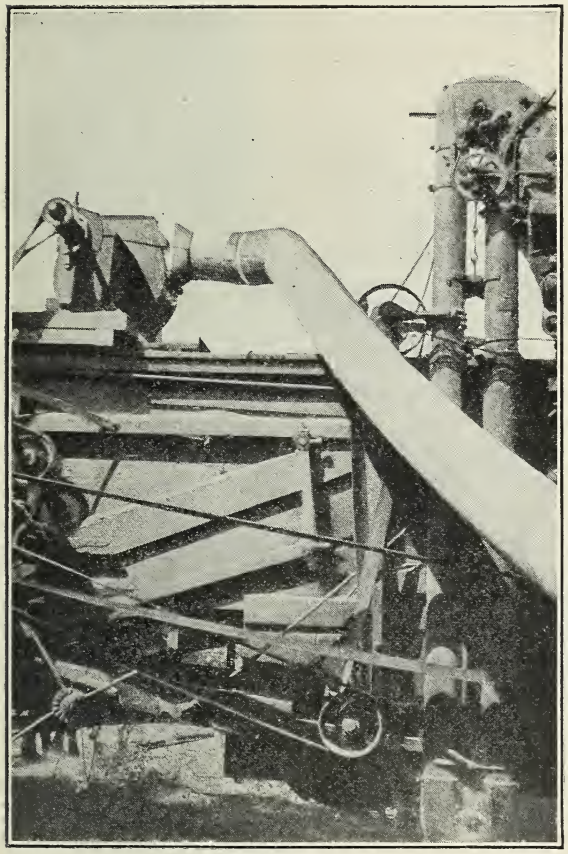

FIGURE 10.

Attention is directed to the idle pulley on the fan which serves to start and stop the fan. More satisfactory results could be obtained with this fan by running it at a speed of about 1,200 revolutions per minute. The alterations described on page 10 probably could be applied to this fan to good advantage. Wooden fans of this type are inexpensive and light running.

7. A remodeled box-type fan (fig. 10).— The fan case was slightly raised and securely placed on a rigid base. The speed was increased to approximately 1,200 revolutions per minute.

The overhang of the fan shaft was remedied by supplying an additional bearing near the pulley, while the fan outlet was enlarged at the casing. The short section of the metallic discharge pipe was equipped with an adjustable 45° elbow. These modifications greatly increased the efficiency of the fan.

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